



PROJECTS IN PROGRESS:

**Genetics, Genealogy and the Molecular
Genealogy Research Project**

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As the level of interest in genealogical research rises in the United States¹ and abroad it becomes increasingly evident that written historical records, which are predominant sources for genealogical information, pose significant limitations to a genealogist's success in constructing a family tree. Some genealogists are exploring the possibility of augmenting traditional genealogical research methods with genetic testing.

Genetic testing for genealogical purposes is a relatively new discipline with many techniques still in early stages of development. Although the technical aspects of these studies can be difficult to understand, the general principles are familiar to most people. Establishing family relationships using genetic analysis is based on the well-known phenomenon of inheritance. Inheritance occurs because every mother and father pass to each child deoxyribonucleic acid (DNA) in the form of chromosomes. The inheritance of DNA thus provides an unbreakable biological link between past, present and future generations. Currently, geneticists can study DNA inheritance patterns on a molecular level, which sheds greater light on inheritance than do studies based solely on physical traits. While many DNA inheritance patterns are complex and difficult to interpret, two methods of genetic analysis known as Y-chromosome (Y-cs) and mitochondrial DNA (mtDNA) testing are relatively straightforward. They are currently available to genealogists and are reliable for establishing certain types of family relationships.

The Y-chromosome is only found in males. It is always passed from father to son. The Y-cs remains essentially unchanged from one

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¹Maritz Marketing Research, Inc., *Sixty Percent of Americans Intrigued by Their Family Roots*, 2000 [online]. (<http://www.maritzresearch.com/apoll/release.asp?rc=195&p=2&T=P>). Assessed June 2001.

generation to the next. Because of these inheritance properties, Y-cs testing can be a valuable tool for surname studies.² Nearly two hundred are currently underway,³ with the number growing each week. Additionally, Y-cs testing was used to support the existence of familial relationships in the highly publicized 1998 Jefferson-Hemings case,⁴ and the Jewish priestly class of Cohen study.⁵

Similar to Y-cs, mtDNA also follows a strict inheritance pattern, along the maternal line. The mother passes her mtDNA to all of her children, but only the daughters pass it to the subsequent generation. Genetic testing based on mtDNA analysis can be used to reveal the existence of a common female ancestor. For example, mtDNA analysis was used to confirm the identity of buried remains thought to be Nicholas II, Czar of Russia, and members of his family, who were killed in 1918.⁶ mtDNA extracted from the remains were compared to that of living relatives sharing a common maternal line and supported a familial relationship. Additionally, mtDNA testing has recently been offered to verify the presence of Native American ancestry along strictly maternal lines.⁷

Although Y-cs and mtDNA analysis can be extremely useful, they are limited to establishing strictly paternal or maternal relationships, represented by the outermost lines on a standard pedigree chart (Figure 1). It is necessary to characterize the complex inheritance of specific regions of DNA found on the remaining chromosomes to elucidate additional family relationships. A massive study is underway at Brigham Young University to do just that. The BYU Center for Molecular Genealogy (BYU Center) in conjunction with the Sorenson Molecular Genealogy Foundation (SMGF) are in the early stages of constructing the world's largest and most comprehensive database of correlated genetic and genealogical data.

²Mark A. Jobling. "In the Name of the Father: surnames and genetics." *TRENDS in Genetics*, 17 No. 6 (2001): 353-357.

³Chris Pomery. "List of Y-Chromosomes Studies Being Undertaken by Family Historians", [online]. (<http://freepages.genealogy.rootsweb.com/~allpoms/genetics1a.html>). Assessed June 2001

⁴Eugen A. Foster, et al., "Jefferson fathered slave's last child." *Nature*. 396 (1998): 27-28.

⁵Karl Skorecki, et al. "Y Chromosomes of Jewish Priests." *Nature*. 385 (1997): 32.

⁶Peter Gill, et al. 1994. "Identification of the remains of the Romanov family by DNA analysis." *Nature Genetics*. 6 (1994): 130-135.

⁷Ancestry.com. "Native America Signature" [online]. (<http://www.ancestry.com/dna/nativeamerican.asp>). Assessed June 2001.

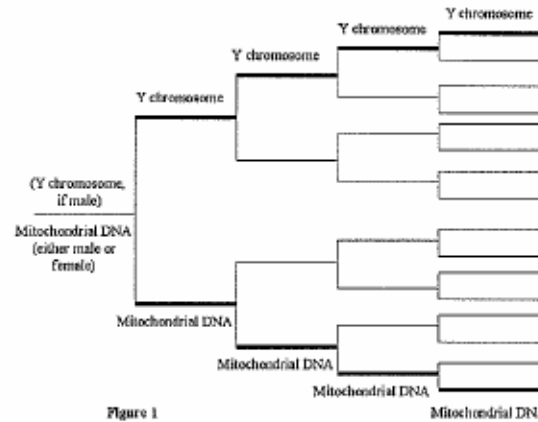


Figure 1

It is anticipated that within the next ten to fifteen years the knowledge gained from the completed database will result in dynamic genealogical tools useful in the reconstruction of individual human genealogies.

To construct the database, the study depends on individual volunteers with known genealogies who donate a pedigree chart of at least four generations, and a small sample of blood from which DNA is obtained and analyzed. The genealogical and genetic information is correlated within the database. All information obtained from volunteers is maintained in strict confidentiality, and volunteers do not receive any individual results from the study.⁸

By studying genetic information in association with corresponding genealogies scientists hope to identify genetic markers or specific regions of DNA that are the result of shared ancestry. These genetic markers will be used to identify the origins of individuals within major world populations, sub-populations, lineages and families. This information can also be used for the molecular identification of missing ancestors, and can establish new genealogical links between living individuals.

⁸Individuals who would like to submit a DNA sample and a pedigree chart to the Molecular Genealogy Research Project can visit the project Web site at <http://molecular-genealogy.byu.edu>, or www.smgf.org, or write to Molecular Genealogy Research Project, 2511 South West Temple, Salt Lake City, UT, 84115 to learn about qualifications and how to participate.

So far, approximately 30,000 DNA samples and pedigree charts have been donated to the BYU study. Although many thousands more are needed to accomplish the research objectives, initial results from analysis of the first few thousand samples have been promising. There has been success in identifying some combinations of genetic markers typical of large world populations. Furthermore, molecular identification of ancestors has also been successful. Many additional findings and the related applications to genealogical research are expected from the study on a regular basis for years to come.

Even though participants do not receive any immediate benefits from participating in the construction of the MGRP database, they should not be discouraged from taking part in it. Knowledge derived from this study will be made available in the future to assist individuals in extending and verifying their personal family histories through molecular techniques, especially with regard of family lines other than the paternal and maternal line. Regardless of previous participation, a person with a family history question will be required to submit a small biological sample. The sample will be used to extract the DNA to answer the family history inquiry posed. Instructions and availability of these future services will be posted regularly on the project Web sites. References to scientific publications and research progress will also be available online.

